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Chen et al.

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(54) **OPTICAL TRANSCEIVER**

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(51) **Int. Cl.**

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G02B 6/42	(2006.01)
H04B 10/25	(2013.01)
H04B 10/43	(2013.01)
H04B 10/50	(2013.01)
H04B 10/60	(2013.01)

(52) **U.S. Cl.**
CPC ***H04B 10/40*** (2013.01); ***G02B 6/3893*** (2013.01); ***G02B 6/4261*** (2013.01); *H04B 10/25* (2013.01); *H04B 10/43* (2013.01); *H04B 10/50* (2013.01); *H04B 10/60* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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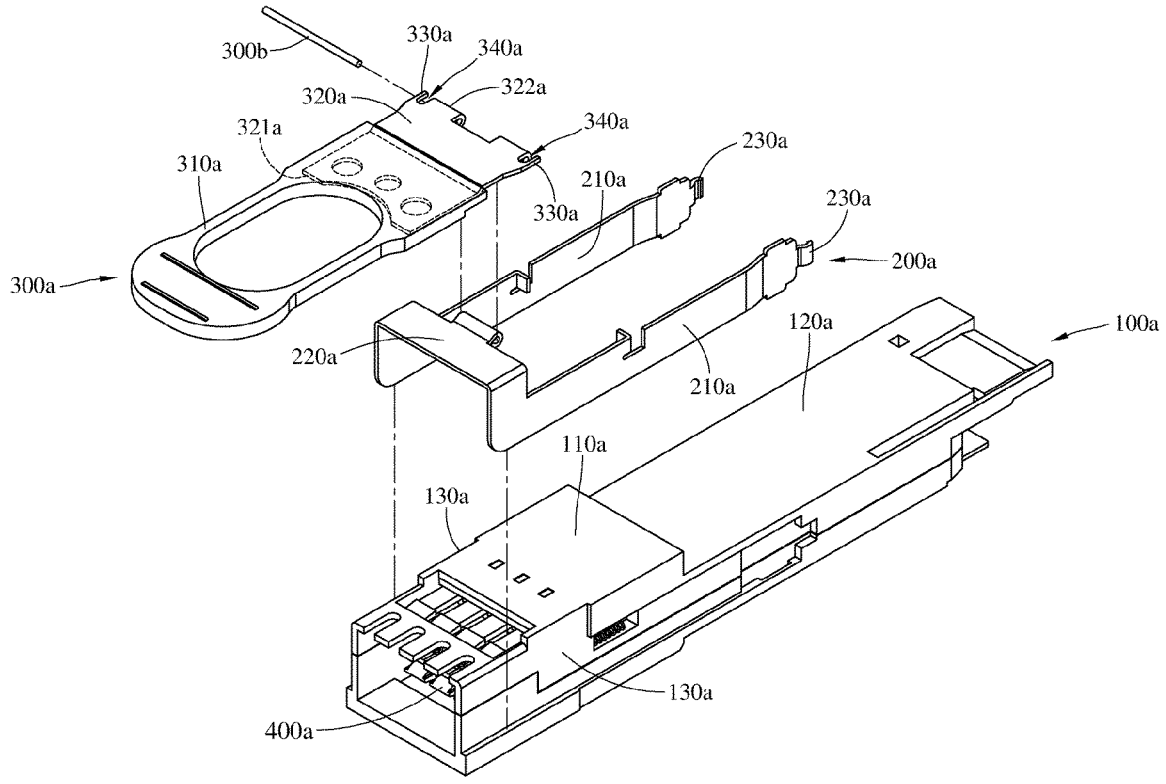
(57) **ABSTRACT**

An optical transceiver includes a housing, a fastening component, and a bail. The fastening component is movably disposed on the housing and configured to be detachably fastened with the cage. The bail is pivoted on the fastening component and includes a holding portion. The holding portion is configured to abut the housing to maintain a pivot angle between the bail and the fastening component.

16 Claims, 9 Drawing Sheets



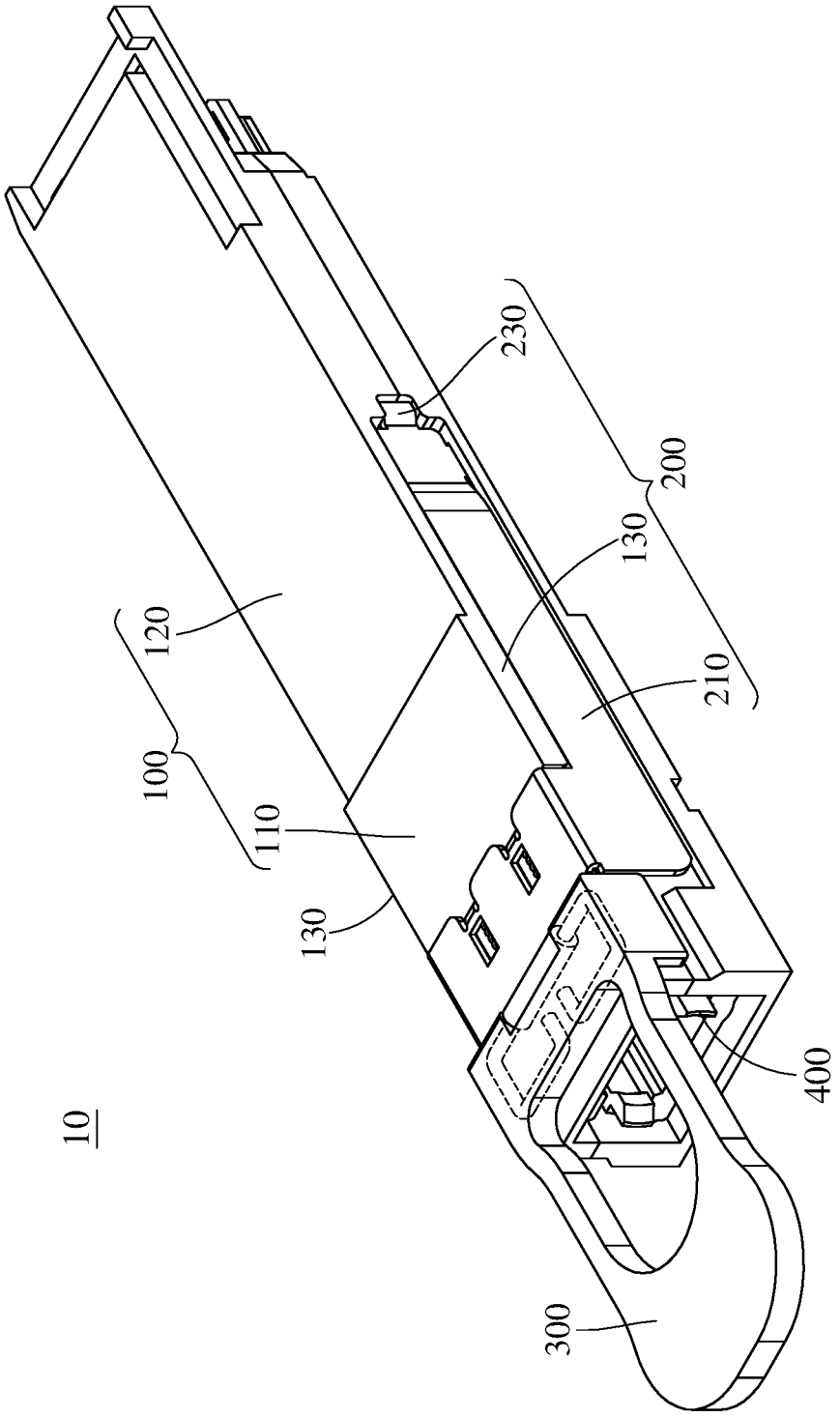


FIG. 1

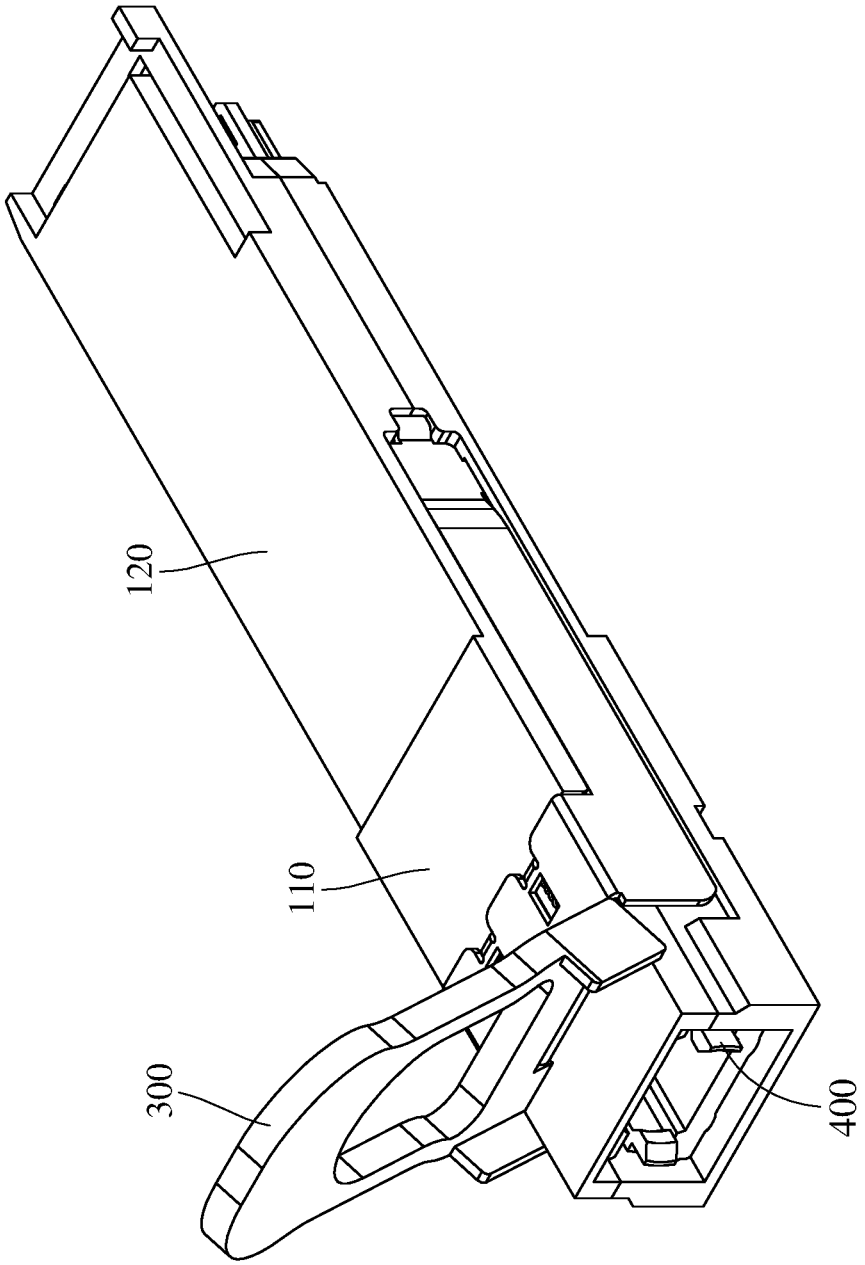


FIG. 2

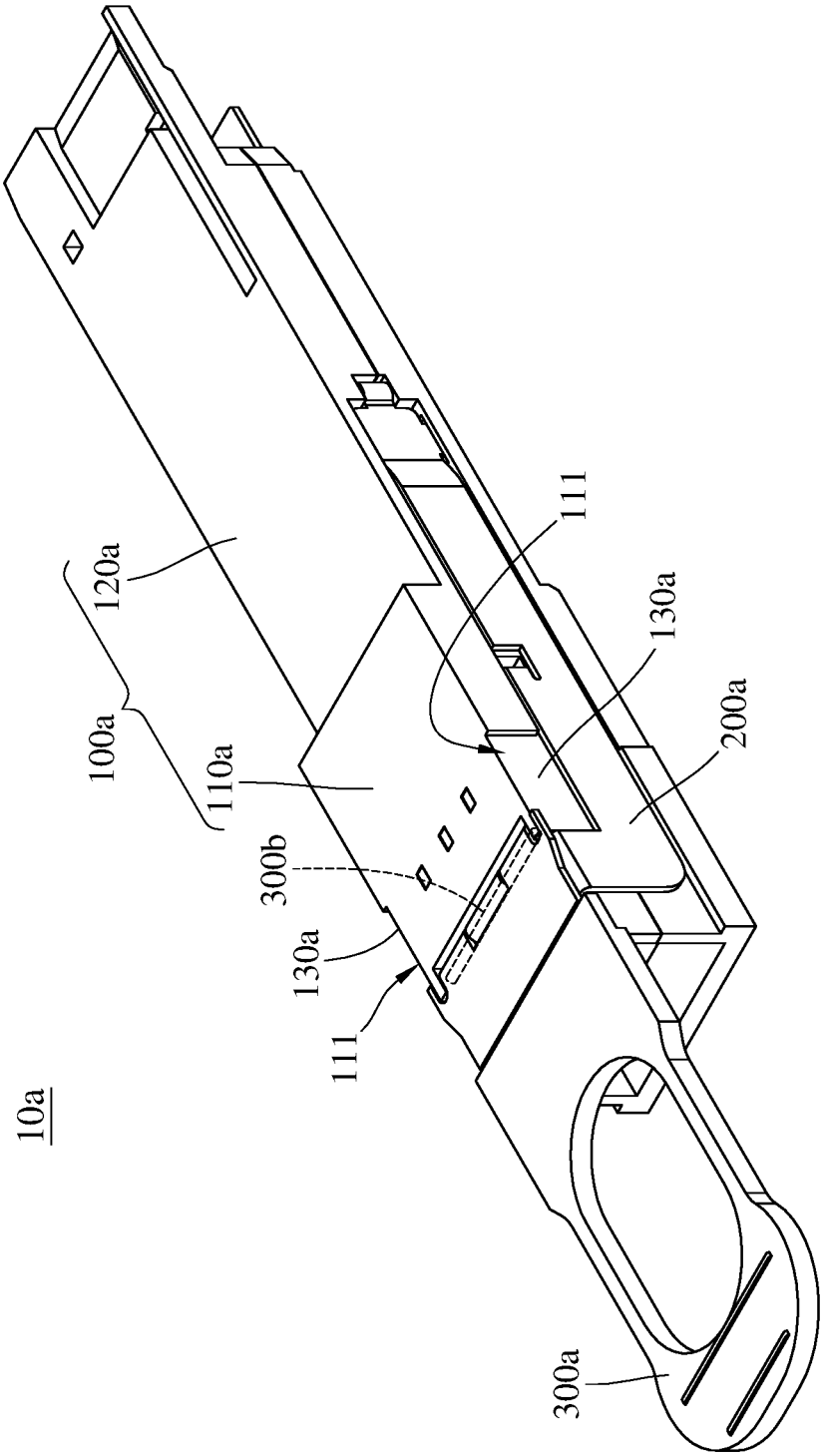
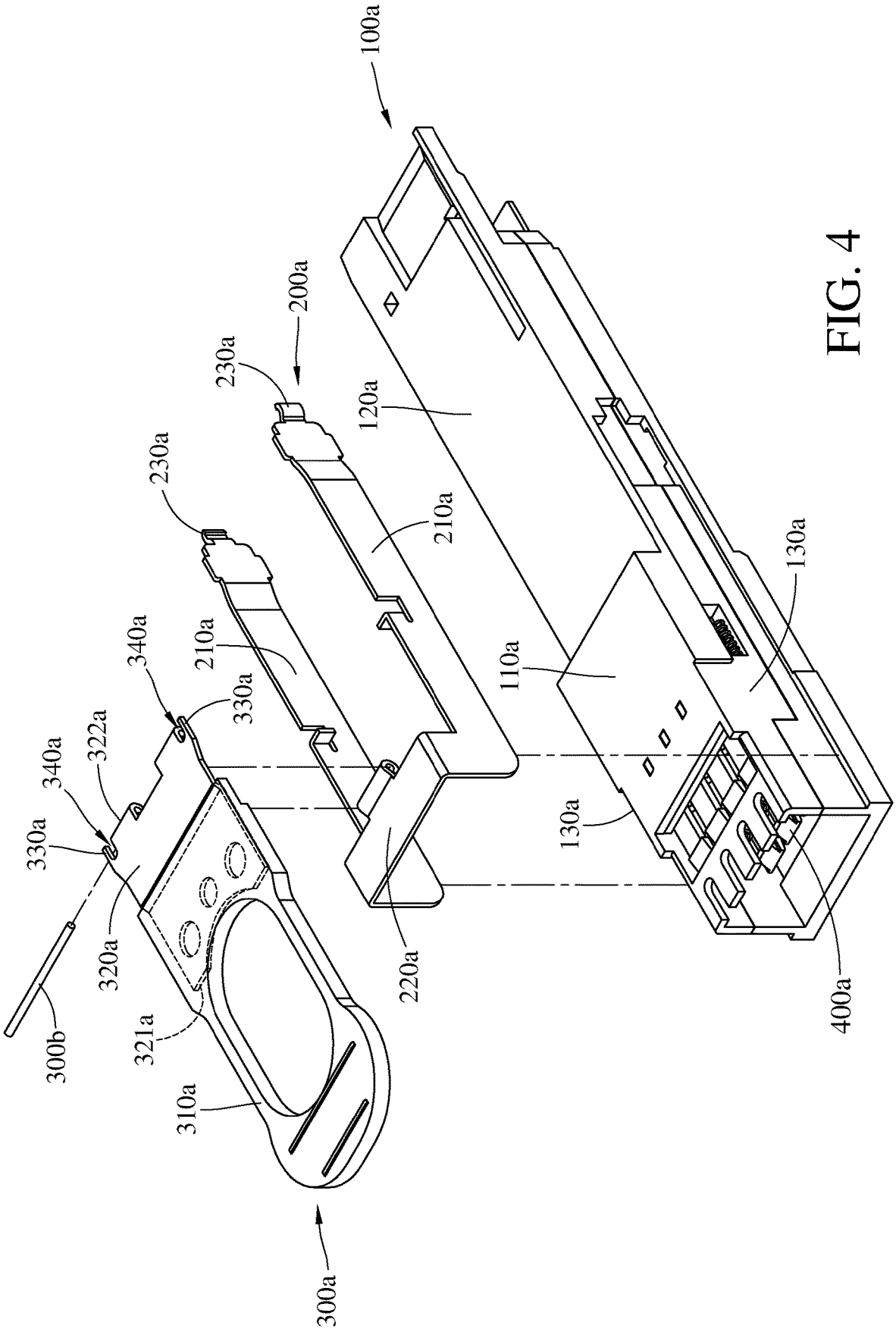


FIG. 3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310a
300a

FIG. 4

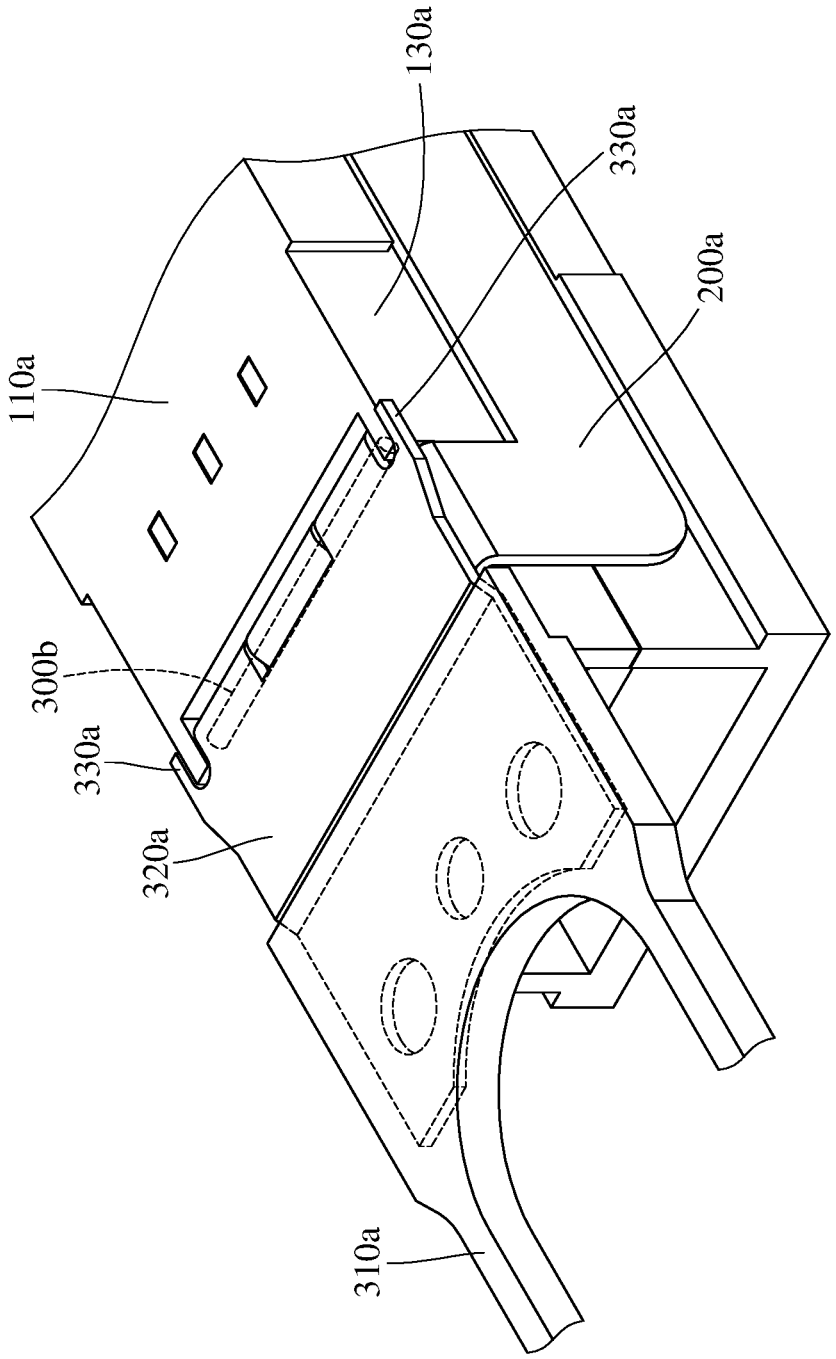

FIG. 5

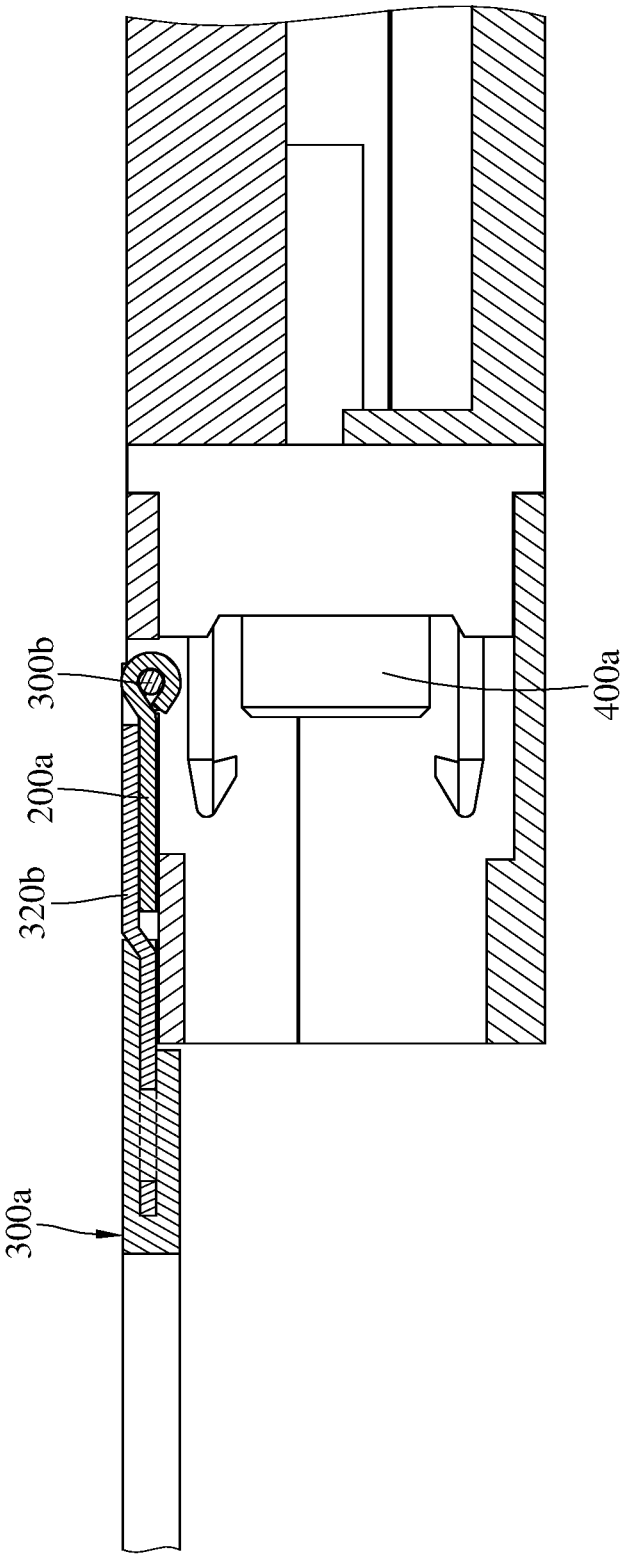

FIG. 6

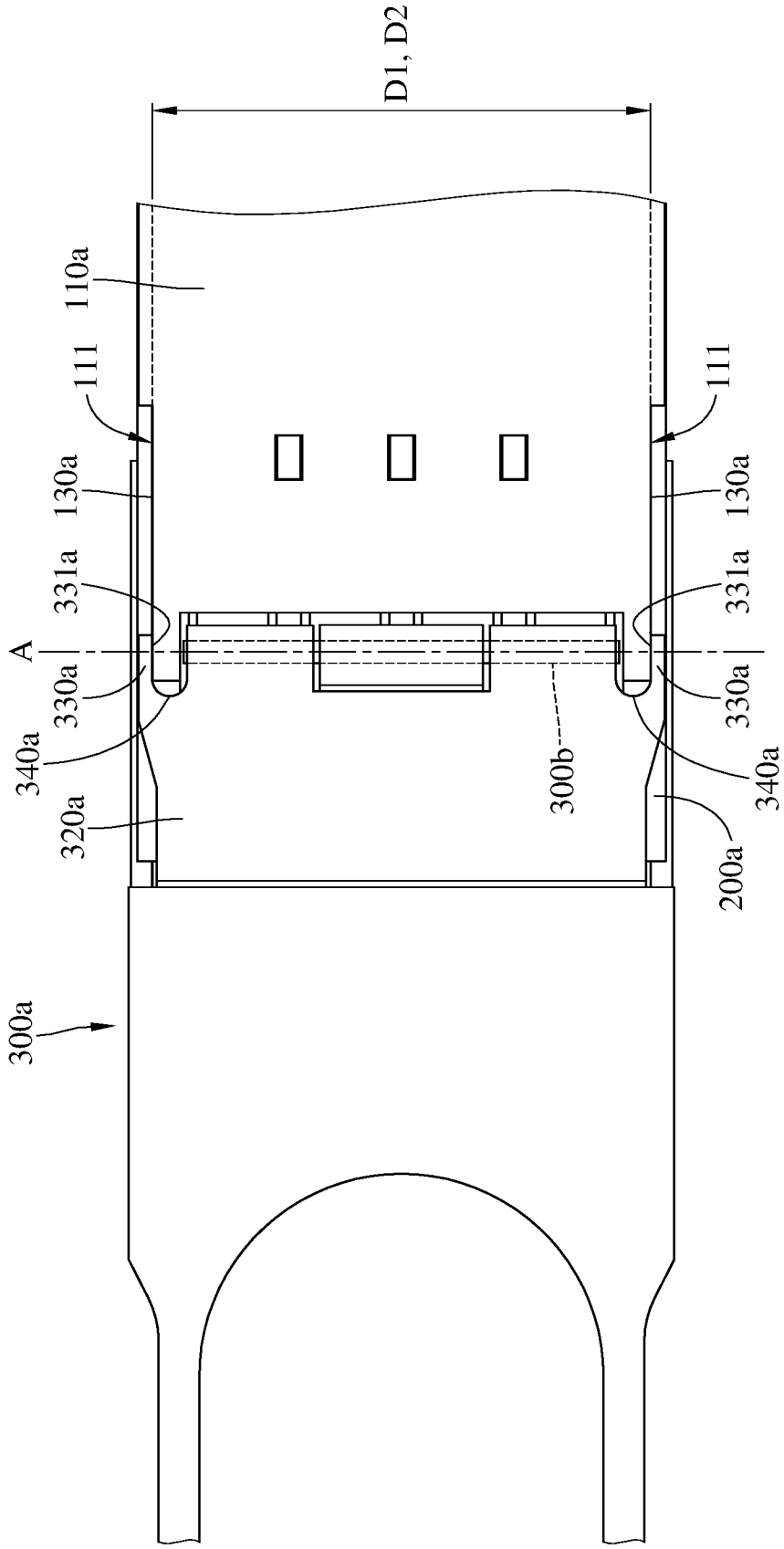
D1, D2
110a
111
111
130a
130a
331a
331a
A
330a
330a
340a
340a
300b
320a
200a
300a

FIG. 7

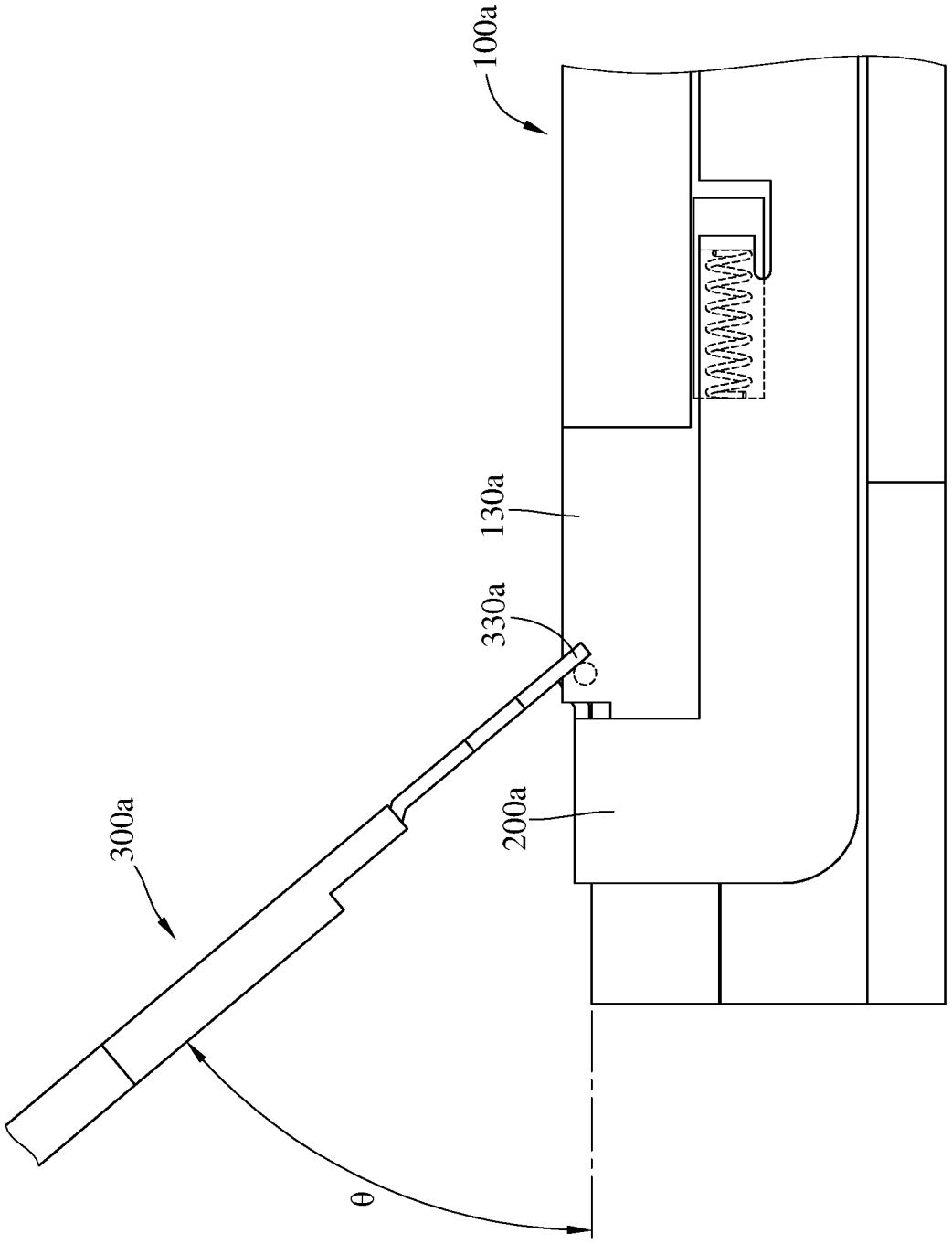

FIG. 8

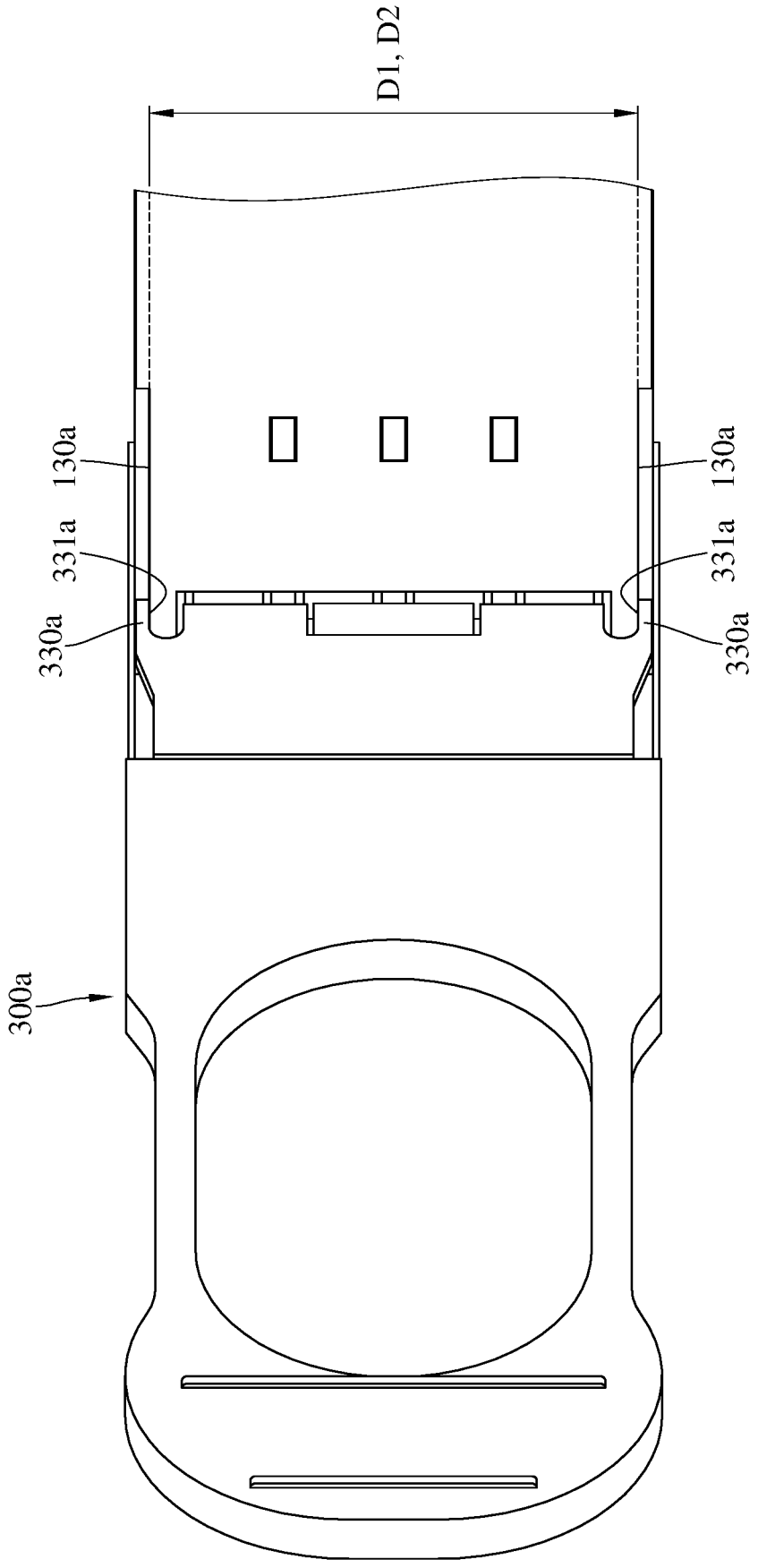

FIG. 9

OPTICAL TRANSCEIVER

BACKGROUND

1. Technical Field

The disclosure relates to an optical communication device, more particularly to a pluggable optical transceiver.

2. Related Art

Optical transceivers are generally installed in electronic communication facilities in modern high-speed communication networks. In order to make flexible the design of an electronic communication facility and less burdensome the maintenance of the same, an optical transceiver is inserted into a corresponding cage that is disposed in the communication facility in a pluggable manner. In order to define the electrical-to-mechanical interface of the optical transceiver and the corresponding cage, different form factors such as XFP (10 Gigabit Small Form Factor Pluggable) used in 10 GB/s communication rate, QSFP (Quad Small Form-factor Pluggable), or others at different communication rates have been made available.

A fastening mechanism is provided for securely fixing the optical transceiver to the cage. On the other hand, the optical transceiver must include a releasing mechanism so that the optical transceiver could be released from the cage smoothly when necessary.

SUMMARY

According to one aspect of the present disclosure, an optical transceiver configured to be inserted into a cage in a pluggable manner is disclosed. Such disclosed optical transceiver in one embodiment includes a housing, a fastening component, and a bail. The fastening component is movably disposed on the housing and configured to be detachably fastened with the cage. The bail is pivoted on the fastening component and includes a holding portion. The two holding portions are configured to respectively abut opposite lateral surfaces of the housing to maintain a pivot angle between the bail and the fastening component.

According to another aspect of the present disclosure, an optical transceiver configured to be inserted into a cage in a pluggable manner is disclosed. Such disclosed optical transceiver in one embodiment includes a housing, a fastening component, and a bail. The fastening component is movably disposed on the housing and configured to be detachably fastened with the cage. The bail is pivoted on the fastening component and includes two holding portions. Each of the two holding portions defines a contact surface. The two contact surfaces respectively abut opposite lateral surfaces of the housing by the rotation of the bail. A distance between the two contact surfaces of the two holding portions is equal to or smaller than the distance between the opposite lateral surfaces of the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will become more fully understood from the detailed description given below and the accompanying drawings which are given by way of illustration only and thus are not intending to limit the present disclosure and wherein:

FIG. **1** is a perspective view of an optical transceiver and a cage according to a first embodiment of the present disclosure;

FIG. **2** is a perspective view of the optical transceiver in FIG. **1**, with a bail at an upright position.

FIG. **3** is a perspective view of an optical transceiver according to a second embodiment of the present disclosure;

FIG. **4** is an exploded view of the optical transceiver in FIG. **3**;

FIG. **5** is a partially enlarged view of the optical transceiver in FIG. **3**;

FIG. **6** is a cross-sectional view of the optical transceiver in FIG. **3**;

FIG. **7** is a top view of the optical transceiver in FIG. **3**;

FIG. **8** is a side view of the optical transceiver with a bail at an upright position; and

FIG. **9** is a top view of the optical transceiver in FIG. **8**.

DETAILED DESCRIPTION

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

Please refer to FIG. **1** and FIG. **2**. FIG. **1** is a perspective view of an optical transceiver and a cage according to a first embodiment of the present disclosure. FIG. **2** is a perspective view of the optical transceiver in FIG. **1**, with a bail at an upright position. In this embodiment, an optical transceiver **10** is disclosed, and the optical transceiver **10** is inserted into a cage (not shown in the drawings) in a pluggable manner. The optical transceiver **10** includes a housing **100**, a fastening component **200**, a bail **300**, and an optical connector **400**.

The housing **100** includes a head portion **110** and an insertion portion **120** connected with each other. The insertion portion **120** is configured to be inserted into a plugging slot of the cage. The head portion **110** of the housing **100** includes two lateral surfaces **130**. A sliding rail is formed on each of the two lateral surfaces **130** and extends from the head portion **110** to the insertion portion **120**.

The fastening component **200** includes two extending arms **210** movably disposed on the sliding rails at the lateral surfaces **130**, respectively. Each of the extending arms **210** includes a fastening portion **230** corresponding to a plugging slot of the cage. The fastening component **200** is movable relative to the housing **100**, and the fastening portion **230** is configured to be fastened with the cage. Therefore, the optical transceiver **10** is readily and reliably inserted into the cage.

The bail **300** is pivoted on the fastening component **200** and extends outwardly from the housing **100**. The bail **300** is in front of the head portion **110** or on the top of the head portion **110**. The optical connector **400** might be disposed in the head portion **110** of the housing **100**.

As shown in FIG. **2**, the bail **300** could be moved around to be located above the head portion **110** of the housing **100**, thereby creating some amount of space for one or more optical fiber jumpers or optical fibers (not shown in the drawings) to be plugged into the optical connector **400** more conveniently. When the bail **300** is at a horizontal position, the bail **300** protects the optical connector **400** from dust, and the insertion portion **120** of the housing **100** is removed from the cage when the horizontal bail **300** is drawn. The bail **300** could be moved from the horizontal position to an upright position so as render less cumbersome the installation or removal of the optical fiber jumpers. However, at the upright position, absent application of any external force

may make the bail **300** simply go back to its initial position, such that extra maneuver of the bail **300** is required for any optical fiber jumper to be plugged into the optical connector **400**.

A configuration of the optical transceiver **10** could be improved. Please refer to FIG. **3** and FIG. **4**. FIG. **3** is a perspective view of an optical transceiver according to a second embodiment of the present disclosure. FIG. **4** is an exploded view of the optical transceiver in FIG. **3**. In this embodiment, an optical transceiver **10***a* is a QSFP-DD (Quad Small Form-factor Pluggable Double Density) optical transceiver, and the optical transceiver **10***a* is configured to be inserted into a cage (not shown in the drawings) in a pluggable manner. The optical transceiver **10***a* includes a housing **100***a*, a fastening component **200***a*, a bail **300***a*, a pivot shaft **300***b*, and an optical connector **400***a*.

The housing **100***a* includes a head portion **110***a* and an insertion portion **120***a* connected with each other. The head portion **110***a* of the housing **100***a* includes two lateral surfaces **130***a* opposite to each other. A sliding rail is formed on each of the two lateral surfaces **130***a* and extends from the head portion **110***a* to the insertion portion **120***a*. The optical connector **400***a* is disposed in the head portion **110***a* of the housing **100***a*.

The fastening component **200***a* includes two extending arms **210***a* and a linkage arm **220***a*. The linkage arm **220***a* is connected with the two extending arms **210***a*. The linkage arm **220***a* is disposed on the top surface of the housing **100***a* . The extending arms **210***a* are movably disposed on the sliding rails at the lateral surfaces **130***a*, respectively. Each of the extending arms **210***a* includes a fastening portion **230***a*. The fastening component **200***a* is movable relative to the housing **100***a* , such that the fastening portion **230***a* is able to be fastened with a cage.

Please further refer to FIG. **5**, which is a partially enlarged view of the optical transceiver in FIG. **3**. The bail **300***a* includes a handle **310***a* , a connecting portion **320***a* and two holding portions **330***a*. The handle **310***a* is connected with a first side **321***a* of the connecting portion **320***a*. The two holding portions **330***a* are connected with a second side **322***a* of the connecting portion **320***a* opposite to the first side **321***a*. The two holding portions **330***a* extend from the second side **322***a* in a direction away from the handle **310***a* . It is worth noting that the number of the holding portions **330***a* is not limited by the embodiments discussed in the present disclosure.

The pivot shaft **300***b* is disposed on the linkage arm **220***a* of the fastening component **200***a* so as to define a pivot joint. The connecting portion **320***a* of the bail **300***a* is pivoted on the linkage arm **220***a* of the fastening component **200***a* via the pivot shaft **300***b*. It is worth noting that the configuration of the optical transceiver **10***a* is not limited by the embodiments discussed in the present disclosure. In some embodiments, the optical transceiver does not include pivot shaft; instead, the bail includes two pins connected with the connecting portion, and the pins are pivoted on the linkage arm of the fastening component to define the pivot joint.

Please further refer to FIG. **6** and FIG. **7**. FIG. **6** is a cross-sectional view of the optical transceiver in FIG. **3**. FIG. **7** is a top view of the optical transceiver in FIG. **3**.

According to one embodiment of the present disclosure, each of the holding portions **330***a* includes a contact surface **331***a* facing toward the lateral surface **130***a* of the housing **100***a*. A normal direction of the contact surface **331***a* is parallel to the axis A of the pivot shaft **300***b* (pivot joint). The two contact surfaces **331***a* respectively abut the opposite lateral surfaces **130***a* of the housing **100***a* by the rotation of the bail **300***a* . The distance D**1** between the two contact surfaces **331***a* is equal to the distance D**2** between the lateral surfaces **130***a*. In some embodiments, the distance D**1** between the two contact surfaces **331***a* is smaller than the distance D**2** between the lateral surfaces **130***a*.

According to one embodiment of the present disclosure, the connecting portion **320***a* of the bail **300***a* is pivoted on the fastening component **200***a* at the pivot joint (pivot shaft **300***b*), and an axis A of the pivot shaft **300***b* extends through the two holding portions **330***a* of the bail **300***a*.

According to one embodiment of the present disclosure, two accommodation grooves **111** are respectively formed on opposite sides of the head portion **110***a* of the housing **100***a*. The two holding portions **330***a* of the bail **300***a* respectively extend into the two accommodation grooves **111**. Therefore, the width of the optical transceiver **10***a* could be further managed so as to be satisfying the different specification requirements of transceiver standards.

According to one embodiment of the present disclosure, a recess **340***a* is formed between each holding portion **330***a* and the pivot shaft **300***b* (pivot joint), and a part of the head portion **110***a* of the housing **100***a* is accommodated in the recesses **340***a*. Therefore, the area of the housing **100***a* touched by the contact surface **331***a* might increase, thereby obtaining a stronger friction fit or interference fit.

Please further refer to FIG. **8** and FIG. **9**. FIG. **8** is a side view of the optical transceiver with a bail at an upright position. FIG. **9** is a top view of the optical transceiver in FIG. **8**.

Referring to FIG. **6** through FIG. **8**, when the bail **300***a* is at a horizontal position, the bail **300***a* protects the optical connector **400***a* from dust. The bail **300***a* could be moved around from the horizontal position to the upright position. When the bail **300***a* is at the upright position, the holding portions **330***a* of the bail **300***a* respectively abut the lateral surfaces **130***a* of the housing **100***a* so as to maintain a pivot angle θ between the bail **300***a* and the fastening component **200***a*. In detail, the contact surface **331***a* of the holding portion **330***a* abuts the lateral surface **130***a* of the housing **100***a*, and a part of the housing **100***a* is located between the two contact surfaces **331***a*. Thus, the pivot angle θ between the bail **300***a* and the fastening component **200***a* is maintained by the interaction between the holding portions **330***a* and the housing **100***a*. In an embodiment that the distance D**1** between the two contact surfaces **331***a* is equal to the distance D**2** between the lateral surfaces **130***a*, the pivot angle θ is maintained by the static frictional force between the holding portions **330***a* and the housing **100***a*. In another embodiment that the distance D**1** is smaller than the distance D**2**, the pivot angle θ is maintained by the interference fit between the holding portions **330***a* and the housing **100***a*. Since the holding portions **330***a* hold the bail **300***a* at the upright position to maintain the pivot angle θ, the installation or removal of the optical fibers without requiring the bail **300***a* being held by hands or any application of external force could be facilitated.

According to the present disclosure, the bail includes holding portions configured to contact the housing, such that the bail is held at the upright position with a pivot angle between the bail and the fastening component. Therefore, it is favorable for convenient installation or removal of the optical fibers without application of external force to hold the bail.

The embodiments are chosen and described in order to best explain the principles of the present disclosure and its practical applications, to thereby enable others skilled in the art to best utilize the present disclosure and various embodi-

ments with various modifications as are suited to the particular use that is being contemplated. It is intended that the scope of the present disclosure is defined by the following claims and their equivalents.

What is claimed is:

1. An optical transceiver, configured to be inserted into a cage in a pluggable manner, comprising:

a housing;

a fastening component movably disposed on the housing and configured to be detachably fastened with the cage; and

a bail pivoted on the fastening component and comprising a holding portion;

wherein the holding portion is configured to abut the housing to maintain a pivot angle between the bail and the fastening component.

2. The optical transceiver according to claim **1**, comprising two holding portions, wherein when the two holding portions abut the housing, a contact surface of each of the two holding portions abuts the housing, and a part of the housing is located between the two contact surfaces of the two holding portions.

3. The optical transceiver according to claim **2**, wherein the bail further comprises a handle and a connecting portion, the connecting portion is pivoted on the fastening component, the handle is connected with a first side of the connecting portion, the two holding portions are connected with a second side of the connecting portion opposite to the first side, and the two holding portions extend from the second side in a direction away from the handle.

4. The optical transceiver according to claim **3**, wherein the connecting portion is pivoted on the fastening component at a pivot joint, and a recess is formed between each of the two holding portions and the pivot joint, and a part of the housing is accommodated in the recess.

5. The optical transceiver according to claim **3**, wherein the connecting portion is pivoted on the fastening component at a pivot joint, and an axis of the pivot joint extends through the two holding portions.

6. The optical transceiver according to claim **1**, wherein the pivot angle between the bail and the fastening component is maintained by interference fit between the holding portion and the housing.

7. The optical transceiver according to claim **1**, wherein the pivot angle between the bail and the fastening component is maintained by static frictional force between the holding portion and the housing.

8. The optical transceiver according to claim **1**, wherein the optical transceiver is a QSFP-DD (Quad Small Form-factor Pluggable Double Density) optical transceiver.

9. An optical transceiver, configured to be inserted into a cage in a pluggable manner, comprising:

a housing;

a fastening component movably disposed on the housing and configured to be detachably fastened with the cage; and

a bail pivoted on the fastening component and comprising two holding portions, each of the two holding portions defining a contact surface, the two contact surfaces respectively abutting opposite lateral surfaces of the housing by rotation of the bail, a distance between the two contact surfaces of the two holding portions being equal to or smaller than a distance between the opposite lateral surfaces of the housing.

10. The optical transceiver according to claim **9**, wherein the two contact surfaces of the two holding portions respectively abut the opposite lateral surfaces of the housing to maintain a pivot angle between the bail and the fastening component.

11. The optical transceiver according to claim **10**, wherein the pivot angle between the bail and the fastening component is maintained by interference fit between the two holding portions and the housing.

12. The optical transceiver according to claim **10**, wherein the pivot angle between the bail and the fastening component is maintained by static frictional force between the two holding portions and the housing.

13. The optical transceiver according to claim **9**, wherein the bail further comprises a handle and a connecting portion, the connecting portion is pivoted on the fastening component, the handle is connected with a first side of the connecting portion, the two holding portions are connected with a second side of the connecting portion opposite to the first side, and the two holding portions extend from the second side in a direction away from the handle.

14. The optical transceiver according to claim **13**, wherein the connecting portion is pivoted on the fastening component at a pivot joint, and a recess is formed between each of the two holding portions and the pivot joint, and a part of the housing is accommodated in the recess.

15. The optical transceiver according to claim **13**, wherein the connecting portion is pivoted on the fastening component at a pivot joint, and a normal direction of the contact surface of the holding portion is parallel to an axis of the pivot joint.

16. The optical transceiver according to claim **9**, wherein the optical transceiver is a QSFP-DD (Quad Small Form-factor Pluggable Double Density) optical transceiver.

* * * * *